

constant in the same species to admit of a comparison with those which I have just described in the shells of the living *Nautilus*.—*Comptes Rendus*, t. cxx. no. 25 (June 24, 1895), pp. 1431–1434.

On the Structure of the Ectoderm and Nervous System in Parasitic Platyhelminthes (Trematodes and Cestodes). By LÉON JAMMES.

The results of my investigations upon the organization and development of Nematelminthes, which I have recently published, contain a detailed study of the ectoderm in these animals. The layer in question is constituted at its first appearance by a continuous epithelium, the superficial growth of which slackens at an early period. Stretchings result from this fact, and consequently a more and more complete dissociation of the entire layer. The cells preserve their epithelial character or become transformed into nerve-elements, fibrils, and granulations. The nerve-elements are differentiated on the spot. The fibrils result from the elongation, accompanied by a special transformation of the epithelial elements; they occupy the spaces left by the non-multiplication or cessation of growth of the cells of the primitive epithelium. The granules are due to the breaking-up of the fibrils. These different elements appear in varying proportions, according as one examines the successive stages of the same individual or of different individuals; they form a single and unique tissue, in which the nerve-elements remain scattered; the latter constitute, by their accumulation at various points of the body, the nervous regions of authors.

These investigations, extended to the Platyhelminthes, have enabled me to determine that the ectoderm of the latter exhibits in its structure numerous points of resemblance to its homologue in the Nematelminthes. We find in both cases epithelial cells, nerve-cells, fibrils, and granulations. Certain authors have described a layer applied to the cuticle; on account of its appearance they have called it *granular*; but by the greater number of them it has been assigned to the mesoderm. This layer really corresponds to the ectoderm, transformed by processes similar to those which I have described in the case of the Nematelminthes.

My investigations have been made upon a Trematode, *Distoma hepaticum*, and upon two Cestodes, *Tenia solium* and *Tenia inermis*. The continuous descriptions of the nervous system of these animals are not such as to enable us to understand its relations to the rest of the ectoderm. Authors have constantly sought to isolate it and to give it definite and precise contours. The regularly increasing complications which they have described in its structure, in proportion as fresh nervous points were recognized, have led us to imagine the existence of a complex framework capable of uniting all the nervous elements distributed in the bodies of these animals. In

reality the nervous system has no definite outlines; the regular arrangements, consisting of sharply defined rings and of divergent cords, which have been attributed to it, cannot be considered as an expression of facts. The apparatus is diffuse and united with the rest of the ectoderm.

In *Distoma hepaticum* the nervous elements present in the various parts of the body appear especially numerous in the cephalic region and at the level of the genital sinus. Around the pharynx in particular we see them surrounding the passage and filling the rounded groove bounded by the external face of this organ and the inner surface of the cuticle enveloping the body. The special reagents show that this mass of nerve-elements, instead of having definite outlines, merges at its margins into the granular layer. The nerves of authors are nothing else than thickenings of this same tissue. It follows that *Distoma hepaticum* possesses, in place of a nervous system consisting of a principal centre (cerebral ganglia) and dependent parts, a fibro-cellular ectoderm in which nerve-elements exist at places, while these elements are especially developed in the regions in communication with the exterior, *i. e.* mouth and genital sinus.

The same state of things exists in the Cestodes which I have studied. Only the changes undergone by the ectodermal layer are perhaps easier to grasp because they appear at different stages in the same individual and according to the age of the segments.

The history of the granular layer of the Platyhelminthes is the same in its general features as that of the ectoderm in the Nematelminthes. Authors have sought at the outset to isolate the nervous system by distinguishing in it centres and dependent parts; this course tended to make of the apparatus of communication an autonomous whole, which it was necessary to delimit. The study of its relations to the ectoderm, which I hope to be able to complete, shows, on the contrary, its entire continuity with the latter, and even thereby obliterates the contours which determined it.

This structure of the ectoderm, common to Platyhelminthes and Nematelminthes, is to be connected with the presence in all these animals of a thick and resistant cuticle; I have already insisted upon this point in my paper on the Nematelminthes; I believe that I am confronted with a histological structure, connected with the existence of an impermeable envelope, which almost suppresses or, in all cases, greatly modifies the relations of the ectoderm to the external medium*.—*Comptes Rendus*, t. cxxi. no. 5 (July 29, 1895), pp. 268-270.

* This paper was prepared at the Natural History Laboratory of the Faculty of Sciences of Toulouse.